Saffordotaxis, n. gen. Like *Nicklesopora*, but one or two rows of megacanthopores surround each zooecium. Type species: *Rhombopora incrassata* Ulrich (1888), 1890, p. 652, pl. 70, fig. 12a–d. Mississippian (New Providence); Kings Mountain, Ky.

Streblascopora, n. gen. Like *Streblotrypa*, but with a central bundle of parallel immature tubes as in *Ascopora*. Type species: *Streblotrypa fasciculata* Bassler, 1929, p. 66, pl. 239, figs. 4, 5. Permian of Timor.

Order CHEILOSTOMATA Busk, 1852

Family Gigantoporidae Bassler, 1935

Stenopsella, n. name for *Stenopsis* Canu and Bassler, 1927, preoccupied by *Stenopsella* Rafinesque, 1815, etc. Type species: *Porina* (*Stenopsis*) *fenestrata* (Smitt, 1873), p. 47. Recent; Gulf of Mexico.

ZOOLOGY.—*The larva of* Hymenolepis californicus *in the brine shrimp* (Artemia salina).

R. T. YOUNG, University of Montana (*emeritus*). *Communicated by* E. W. Price.)

In 1933 Stammer described a remarkable cestode larva, *Cysticercus* (*Cercocystis*) *mirabilis*, in the water flea (*Daphnia magna*), which he postulated to be the larva of a *Hymenolepis* or *Aploparaksis* but was unable to verify his suspicion by feeding experiments on ducks, either domestic or wild. And examination of wild birds (2 *Podiceps cristatus*, 3 *Anas querquedula*, and 2 *Anas platyrhyncha*) from *Daphnia* ponds failed to reveal any cestodes whose hooks were similar to those of this larva. The most striking feature of Stammer's larva is the length of its tail (2.2–5.2 cm) while the body is only 0.091–0.104 mm long. Thus the parasite may be ten times the length of its host. I have found what is the same or a closely related species, in the brine shrimp of Mono Lake and salt pools near Chula Vista, Calif., which I here describe, together with a note on its life history.

Technique.—The larva has been studied mainly in freshly dissected shrimp flattened beneath a cover glass, but specimens fixed in Dubosq-Brazil's modification of Bouin's solution and stained in acetocarmine and Ehrlich's haematoxylin have also been employed.

The larva.—The larva, which corresponds to the "cyste" of Stammer, is an oval or oblong body varying in length from 0.073 to 0.256 mm in fresh specimens, and in diameter from 0.044 to 0.088. Six specimens averaged 0.153 in length and three 0.061 in diameter. They are encased in a heavy membrane or cuticle enclosing many round or oval chalk bodies, and a crown of 10 hooks, one of which is shown in Fig. 1. These hooks also vary in size from 0.008 to 0.017 mm. These differences in size of body and hooks are undoubtedly mainly developmental.

Most of these larvae lie free in the body of the shrimp, but some of them are surrounded by a sack, to which is appended a tail of variable length. There is a small depression (pore?) in the membrane at the head end of the larva. Accurate measurement of the tail is impossible because of its bent and twisted form, being rolled about itself spirally as described by Daday (1900) in other species. I have however made an approximate estimate of its length in one specimen, illustrated in Fig. 2. In this it extended about 7 mm from the larval sack. Making due allowance for the amount of bending and coiling the length of this tail must have been at least 20 mm, which is considerably less than that recorded by Stammer.

My interest in this study was primarily ecological rather than morphological. Nevertheless I have made a sufficient comparison of my larva with that described by Stammer to convince me of the probable identity of the two forms.

Whether the free larva represents an early stage, the sack and tail being developed later, or a later stage, these structures having degenerated and disappeared, is an open question. Stammer apparently inclines to the latter view, for he says (p. 81) that in copepod infesting larvae the tail degenerates, and since there are a number of the latter which "in ihrem Bau dem unserer Form ähneln . . . (I cannot deny) dass diese Schwanzanhänge alle anzeichen einer ausgesprochenen Degeneration zeigen." However, on page 82 he describes one case of a young larva in which "die Cyste mit dem Scolex und den Haken war bereits vollständig ausgebildet, dagegen hatte der Schwanzanhang noch nicht seine endgültige Struktur angenommen." I believe that both sack and tail are secondary developments, for I have seen what were undoubtedly different stages of the larva in one of which it was enveloped in a thin walled colorless sack containing only a few granules, while the fully developed larvae are surrounded by heavy sacks, brown in color and not transparent. Furthermore, the length of the tail varies in different specimens. In some it is but little longer than the larval body, while in others it exceeds this length one hundred fold or more. Sack and tail appear to develop later in the year, being more common in autumn than in summer. That sack and tail could be readily absorbed or ejected by the shrimp, as must be the case if they are degenerate structures, does not appear probable. And I have never seen fragmentary sacks or tails lying free in the body of the shrimp as might be expected if they were degenerate and in process of elimination. In only one case have I seen a larva lying free beside its sack and tail and in this instance a split in the former indicated the extrusion of the larva therefrom by extraneous pressure.

Many other cercocystis larvae have been described by various authors,[1] but none of them resemble *C. mirabilis* or the present form.

The life history.—Mono Lake, Calif., is the summer home of a colony of California gulls, *Larus californicus* (Young, 1950), which have nested for many years on an island in the lake. These gulls feed extensively on the larvae and pupae of the salt fly, *Ephydra*, and I at first assumed that these were the intermediate hosts of the tapeworm *Hymenolepis californicus*, which infests the gulls. However, feeding many hundred maggots and pupae to two young gulls which I hatched and reared in the laboratory was without result and an examination of several dozen of the former revealed no parasites, so that we can safely say that the fly larvae are not the intermediate hosts of the worm. An examination of several hundred brine shrimp from Mono Lake and the salt pools near Chula Vista revealed many specimens of the larva which feeding experiments with young gulls proved to be the larval stage of the tapeworm in the latter. In both 1950 and 1951 I obtained several specimens of the recently hatched birds and hatching eggs in the colony. All the young out of the nest I examined were infested with this parasite, and 9 of 16 nestling birds harbored from one to many specimens. Of 14 hatching eggs I obtained in 1951, 7 of the birds subsequently died and 2 were used for other experiments, leaving 5 available for the present research. Feeding shrimp to these five birds resulted in infesting four of them with from one to ten worms. The birds were fed frozen fish and horse meat containing no live parasites.

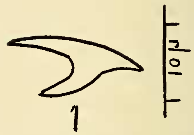

FIG. 1.—Camera drawing of a larval hook.

Reverse experiments (transmission of parasites from bird to shrimp) were universally unsuccessful. Neither feeding eggs of the worm, some of which at least contained active embryos, to the shrimp nor placing the latter in dishes with feces of birds known to be infested gave a positive result in any experiment. This raises the question of the existence of any other possible organism on which the shrimp feed, but in the first place the latter feed mainly on nannoplankton, and in the second place it is very doubtful if any organism large enough to harbor the eggs of the parasite could be ingested by the shrimp.

There is some indirect evidence, however, which points rather strongly to a direct transfer from bird to shrimp. During the nesting season in June and July the gulls stay rather closely by their nests on the island, leaving it only to forage for food at a garbage dump on the lake shore or in nearby lakes in the mountains. In August and September, however, when the young are able to fly they are present in large numbers along the lake shore, picking up the fly larvae on which they feed, and depositing their feces in the water. In the former months a collection of 41 shrimps along the lake shore contained 9 larvae, while in August and October there were 100 larvae in 125 shrimp examined. These results are set forth in the following table which shows the dates of examination, the number of shrimp examined and the number of larvae per shrimp.

[1] See especially Daday (1900) and Hall (1929).

Date 1951[2]	*Number of shrimps*	*Number of larvae per shrimp*
June 15–17	6	2/6
July 14	20	1/20
19	3	0/3
20	3	0/3
August 1	9	5/9
19	30	5/30
20	20	5/20
22	32	2/32
23	2	0/2
24	2	1/2
October 8	5	9/5
9	6	11/6
13	13	19/13
21	5	12/5
24-5	10	36/10

I have divided these experiments into two groups, one group including those from June 15 to August 1 inclusive, and the other including the remainder, and computed the probability of the results, based solely on chance, from a formula in Tippett (1937), i.e.,

$$T = \frac{X - X'}{S\sqrt{1/N + 1/N}}$$

where X and X' are the larger and the smaller averages respectively of two sets of observations, N and N' the corresponding number of observations and

$$S^2 = \frac{\Sigma(x - X)^2 + \Sigma(x' - X')^2}{N - 1 + N - 1}$$

x and x' being the value of a given observation, i.e., the number of larvae in one shrimp. Knowing the value of T and the number of observations the probability of the result can be determined from a table compiled by Dr. George F. McEwen, of the Scripps Institution of Oceanography.[3] Applied to the present series of observations this formula becomes

$$T = \frac{.8 - .22}{S\sqrt{1/125 + 1/41}} = \frac{.58}{S \times .057}, \text{ and } S = \frac{220.96 + 11.35}{124 + 40} = 1.4.$$

$$T, \text{ therefore } = \frac{.58}{1.4 \times .057} = 7.25 \text{ and the probability } = 0.$$

Had these observations been arranged differently, grouping all those in summer in comparison with those in October, after the shrimp had been exposed to the gulls for a longer time, the contrast would have been even greater.

Further indirect evidence of the passage of the parasite from bird to shrimp is afforded by an examination of the latter from the salt pools at Chula Vista in different seasons in comparison with that of the Mono Lake shrimp at the same time. In June and August 1951, when the gulls were numerous at Mono Lake, but rare or absent from the salt pools, the ratio of the infested shrimp in the former locality was 19/127, or 15 per cent, while that in the latter was 15/242, or 6.2 per cent.

Seasonal variation in abundance of *Cercocystis* in Entomostraca in relation to the presence or absence of their definitive hosts in different seasons has already been described by Daday (l.c.) and need not be further discussed here.

It is obvious that this indirect evidence is not *proof* of infestation of the shrimp by the gulls. It is possible, though very improbable that a third organism is involved. But the relationship between the amount of infestation of the shrimp and the abundance of the gulls at different seasons is very suggestive.

FIG. 2.—Microphotograph of a larva, showing the tail, × 9.3

The seasonal abundance of this larva is very different from that of Stammer's but the difference in the ecology of the daphnid and the shrimp and the different localities in which they are found may readily explain this.

Summary.—A remarkable cysticercoid (*Cercocystis*) in the brine shrimp of Mono Lake and the Chula Vista salt pools in California is described and figured. It resembles very closely, if it is not identical with the *Cysticercus mirabilis*

[2] Dates given are those of examination of the shrimp. Dates of collection were June 12, July 12, August 17, and October 6.

[3] This table is based on one in Fisher's *Statistical methods for research workers*, but is more comprehensive.

of Stammers (l.c.). (Should subsequent experiments prove the correctness of my assumption that this larva is identical with *Cysticercus mirabilis*, the specific name *californicus* will be superseded by *mirabilis*, which has priority.)

Feeding experiments with gulls (*Larus californicus*) have proved it to be the larva of *Hymenolepis californicus*, a parasite of this bird. It has not been possible to infest the shrimp with the larvae of the worm, but the percentage of infested shrimp in different seasons in relation to the abundance of the gulls at those seasons is strong indirect proof of the transfer of parasite from bird to shrimp.

Acknowledgments.—It gives me much pleasure to acknowledge my indebtedness to the San Diego Zoological Society and the U. S. Bureau of Animal Industry for the privilege of occupying rooms in their laboratories and for many courtesies during the prosecution of this research. I am especially indebted to Dr. K. C. Kates of the latter institution for the microphotograph.

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HELMINTHOLOGY.—*Helminths from the Republic of Panama:* II, *A new trematode from the intestine of* Philander laniger pallidus *Thomas and key to the species of the genus* Phaneropsolus *Looss, 1899* (*Trematoda: Lecithodendriidae*).

Eduardo Caballero y C., Institute of Biology of Mexico, and Robert G. Grocott, Board of Health Laboratory, Ancon, Canal Zone.

The trematodes described below were collected in August 1950 from the intestine of a woolly opossum. The material consists of 15 specimens, all of which are whole stained mounts fixed without compression.

Phaneropsolus philanderi, n. sp.

The body in all specimens of the trematode is small, round in form, or shaped like a truncated cone with the anterior portion slightly narrowed and the posterior wide and flat. The flukes measures from 1.077 to 1.096 mm long by 1.096 to 1.172 mm broad. Cuticula 0.004 mm in thickness and in anterior region of ventral surface armed with numerous small, conical spines measuring 0.004 mm long. These spines are less numerous at the testicular level and disappear in the posterior part of the body. Spines very sparse on dorsal surface. Oral sucker is larger than acetabulum, almost spherical or widened transversely, terminally placed, muscular and measures 0.130 to 0.160 mm long by 0.210 to 0.227 mm broad. The spherical acetabulum is situated immediately anterior to the body equator, a little anterior to the reproductive glands and posterior to cirrus pouch at a distance of 0.294 to 0.344 mm from anterior end, and measures 0.134 to 0.168 mm long by 0.126 to 0.152 mm broad. The sucker ratio is 1:1.19 by 1:1.6 to 1:1.29 by 1:1.4.

The mouth is circular or slightly lengthened in transverse diameter and measures from 0.025 to 0.055 mm long and 0.109 to 0.118 mm broad. Prepharynx absent. Pharynx small, muscular, globoid, with transverse diameter greater than the anteroposterior and measures 0.055 to 0.067 mm long by 0.088 to 0.097 mm broad. Esophagus absent. Intestinal ceca short and narrow and extend dorsolaterally to the midtesticular zone.

The large circular genital pore is surrounded by a wide circular band of nucleated cells, measures 0.034 mm in diameter, and is situated slightly to the right of the midline at the level of the posterior border of the pharynx and 0.210 to 0.252 mm from the posterior end of body. The testes are laterally located in the equatorial plane of the parasite; they are spherical or oblong in shape, with smooth contour, size greater than that of ovary and one testis usually being larger than the other; right testis measures 0.134 to 0.185 mm long by 0.168 to 0.206 mm broad, while the left measures 0.168 to 0.273 mm long by 0.181 to 0.218 mm broad. The cirrus pouch is very long, tubular, located in the ventral region in front of the acetabulum and reproductive